Are skin scar characteristics associated with the degree of pelvic adhesions at laparoscopy?

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Objective: To investigate whether individual or a combination of abdominal surgical scar characteristics can predict the severity and extent of intra-abdominal adhesions.
Design: A prospective cohort study.
Setting: A tertiary referral center in the United Kingdom.
Patient(s): One hundred women who had previously undergone abdominopelvic surgery and were undergoing an elective laparoscopic gynecologic operations.
Intervention(s): Abdominal scars were evaluated preoperatively using the modified Manchester Scar Questionnaire Adhesions were assessed intraoperatively and compared with the cutaneous findings.
Main Outcome Measure(s): Presence and severity of intra-abdominal adhesions.
Result(s): Of 100 women recruited into this study, 71 (71%) women were found to have intra-abdominal Aadhesions, and 29 (29%) had no adhesions. Women who had more than one abdominal scar, a palpable scar, and/or a longer scar were most likely to have pelvic adhesions during the current surgery. Women with the highest mean scar scores also had a greater total adhesion score.
Conclusion(s): Adhesions are a common postoperative consequence of open or laparoscopic surgery. Skin scar characteristics are associated with the presence and degree of pelvic adhesions. Future studies should examine whether these characteristics can be used as a preoperative predictive tool to facilitate surgical decision-making and elective operating room organization. (Fertil Steril® 2014;101:501–5. ©2014 by American Society for Reproductive Medicine.)
Key Words: Adhesion, laparoscopy, scar, skin

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Patients who undergo repeat intra-abdominal or pelvic surgery present intraoperatively with different degrees of postsurgical adhesions (1–3). Performing secondary procedures in patients with adhesions accrues higher surgical risks and results in longer operating times than operating on a patient for the first time (2). Adhesions are a known cause of perioperative and postoperative complications and place a significant burden on healthcare resources. As a frequent cause of hospital readmission, with 5.7% of all postoperative readmissions being directly related to adhesions, some patients with adhesion-related-morbidity require repeat surgery (4). Although it is intuitive to assume that laparotomies result in more intra-abdominal scarring and adhesion-related morbidity than laparoscopy, several studies have shown that laparotomy and laparoscopy are associated with comparable risks of adhesion-related operative and nonoperative morbidity (5, 6).

Surgeons often use the past surgical history of a patient to indicate the degree of adhesions expected during subsequent operations. In practice, this usually relies on patient recall, as documented evidence and information may not always be readily available. Radiologic imaging cannot accurately diagnose intra-abdominal adhesions in the absence of acute pathology, so there is currently no reliable noninvasive clinical method of determining the presence or severity of intra-abdominal adhesions before surgery.

There are striking similarities in how the skin and peritoneum respond

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to injury and trauma, with a large overlap in the mechanism of healing in both the dermis and the mesothelium. First, they both involve an initial acute inflammatory response in which chemotactic and proinflammatory cells migrate to the wound site and there is activation of the coagulation and fibrinolytic pathways. Second, there is a common cellular proliferative phase; within the skin and peritoneum, this involves the migration and proliferation of cells, in particular an abundance of keratocytes and mesothelial cells. In addition, both organs exhibit a continuous extracellular remodeling phase (7), which emphasizes the dynamic nature of healing and scarring (8–10). Given the biologic similarities between the healing processes of the both skin and the peritoneum (3, 11–13), skin scar characteristics may be an external reflection of the state of intra-abdominal adhesion formation and peritoneal healing. The degree of association of skin scar characteristics and intra-abdominal or pelvic adhesions has not been thoroughly investigated. We hypothesized that the skin scar characteristics of women who have undergone previous surgery is associated with the presence, extent, and severity of intra-abdominal adhesions.

MATERIALS AND METHODS

Study Design

Female patients attending gynecology preoperative admissions at a tertiary referral university hospital, Southampton United Kingdom, were invited to take part in this study. Eligible women were those undergoing elective laparoscopic surgery for benign gynecologic conditions. Selection criteria included women over the age of 18 years who had also undergone at least one previous abdominal or pelvic operation (either a laparoscopy or laparotomy). A total of 100 women were recruited. Women were excluded if they had a preexisting diagnosis of endometriosis, had suffered a previous postoperative wound infection, or were currently pregnant.

All participants provided informed consent and were recruited in accordance with local policy. Ethics approval was granted by the Isle of Wight, Portsmouth and South East Hampshire Research Ethics Committee (reference number 08/HO501/87).

Scar Assessment

A member of the research team performed a detailed scar assessment when the patient was anesthetized, lying prone in Lloyd-Davies position, with the main operating light focused over the abdomen. To avoid bias, the researcher who assigned the scar score was not present at the surgery, and the surgeon who graded the adhesion score was not notified of the skin scar score. The position of the scar was recorded pictorially and the scar was compared against the modified Manchester External Scar Scale (14).

The modified Manchester External Scar Scale is a validated written questionnaire (15) that accommodates a wide range of different scar types and uses clinically significant descriptors, which have been shown to have a good correlation with overall histologic score (14). It assesses and rates seven scar parameters: color, (perfect, slight, obvious, or gross discrepancy compared with surrounding abdominal skin), texture (normal, just palpable, firm, or hard), margins (distinct or indistinct), size (<1 cm, 1–5 cm, or >5 cm), contour (flush with surrounding skin, or stands proud), surface appearance (matt or shiny), and number (single or multiple scar sites). The sum of these points assigns a score with low value representing minimal scarring, and a high score if more marked scarring or abnormal scarring is present. In the 44 (44%) women who had multiple assessed scars, the numerical value of each scar characteristic providing the highest scar score was used in the statistical analysis, and a mean scar score was calculated. Information was obtained on medical history related to abnormal skin scarring, details of previous surgery, scar symptoms, any previous treatment of scar tissue, and details of any wound infections.

Adhesions Assessment

Assessment of adhesions performed upon entry to the abdomen, before operating. The operating surgeon was asked to report the anatomic sites, severity, and extent of coverage of adhesions. This information was used to complete the validated More Comprehensive Adhesion Scoring Method (16). Adhesions were then mapped to one of a possible 23 sites within the abdomen and pelvis. This score-based system employs two independent measurements; the severity (flimsy to cohesive) and extent (percentage of area covered or length of adhesion) of adhesions at each site. The numerical score (0–6) assigned to each area of adhesions comprises the severity (0 = none; 1 = filmy/avascular; 2 = some vascularity and/or dense; 3 = cohesive) and extent (0 = none; 1 = coverage $<26\%$; 2 = coverage 26%–50%; 3 = coverage $\geq 51\%$), with the sum of these sites producing the final score. The surgeon performing the scoring of intraoperative adhesions was not a member of the research team and was not provided with the results of the scar-assessment information.

Statistical Analysis

All data were analyzed using the SPSS statistical package version 21 (SPSS, Inc.). The association between presence of adhesion and other categorical variables was examined using the chi-square test. Group differences were evaluated using independent samples *t*-test or one-way analysis of variance, with Mann-Whitney *U* test for non-normally distributed data. Bivariate correlations were drawn by Pearson product-moment correlation coefficient test or Spearman's rank correlation test. $P < .05$ was considered statistically significant. Data values are represented as mean ± standard deviation (SD).

We assumed an aberrant scarring pattern in 60% of women with adhesions, in accordance with data published after assessment of scars after cesarean deliveries (17). Our power calculation was based on an alpha error of 0.05 and beta error of 0.2. The assumed rate of adhesions was 35% in normal skin, compared with 65% in those with a poorer scar (i.e., skin characteristics that led to a greater mean scar score). The skin characteristics leading to a "poorer" scar were those skin qualities that most contrasted with the native skin: having a longer, harder, more pigmented scar which differed in contour and appearance to the surrounding skin.